Original Article

Glue-assisted intrascleral fixation of posterior chamber intraocular lens

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Purpose: To analyze the visual outcome of patients undergoing glue-assisted intrascleral fixation of posterior chamber intraocular lens (IOL) in the absence of posterior capsular support. **Materials and Methods:** This retrospective study analyzes 25 eyes which underwent IOL implantation by the glued intrascleral fixation technique. The pre and post-operative uncorrected visual acuity (UCVA), pre and post-operative best corrected visual acuity (BCVA), intraocular pressure (IOP), IOL position, anterior chamber reaction and central macular thickness were assessed and recorded. Immediate and late post-operative complications were also recorded. **Results:** A total of 25 eyes of 22 patients were reviewed and analyzed over a period of one year. All eyes had a foldable three-piece IOL implanted. About 84% of the eyes had a gain of one or more lines, 12% had no gain, and 4% had a fall of three lines of BCVA on Snellen's visual chart, which was attributed to cystoid macular edema (CME). Postoperatively, there was a significant improvement in the UCVA ($P < 0.05$) and in the BCVA ($P < 0.05$). Postoperative complications included decentration in one case and vitritis with chronic macular edema in another case. Optical coherence tomography (OCT) demonstrated well placed IOL with no tilt. **Conclusion:** Although the results of one year follow-up of glued intrascleral fixation are promising, long term studies are recommended.

Access this article online

Website: www.ijo.in

DOI: 10.4103/0301-4738.112160

Quick Response Code:

Keywords: Fibrin glue, glued intrascleral fixation, glued intraocular lens forceps, three-piece foldable intraocular lens

The endocapsular placement of an intraocular lens (IOL) is undoubtedly anatomically most preferable following successful cataract extraction. However, the presence of an unstable capsule-zonule complex or its absence, as with a dislocated lens or pseudoexfoliation syndrome, preempts the endocapsular fixation of the IOL.[1] The implantation of an IOL in the capsular bag provides stable fixation at a position closest to the nodal point of the eye.[2]

IOL implantation in eyes that lack posterior capsular support has been accomplished in the past by using iris-fixated IOL, anterior chamber (AC) IOL and transscleral IOL fixation through the ciliary sulcus or pars plana.[1]

Because of their anatomic location, scleral-fixated PC IOL's have a theoretic advantage over other IOL's with regard to complications, especially in eyes after trauma and in young patients.[3-5] They provide better visual acuity and binocularity, lead to a lower incidence of strabismus than contact lenses, and avoid the complications of AC IOL's, which are seen more with rigid closed loop IOLs than with open-loop and iris-claw IOL's.[5-9]

Glued intrascleral fixation is a technique that helps to implant a posterior chamber (PC) IOL in eyes with a deficient posterior capsule. A quick-acting surgical fibrin sealant derived from human blood plasma, which has both hemostatic and adhesive properties,[10] is used to seal the sclera flaps. Fibrin glue has been used in various medical specialities as a hemostatic agent to arrest bleeding and seal tissues and as an adjunct to wound healing.[11,12]

Materials and Methods

Medical records of 25 eyes of 22 patients who had glued intrascleral fixation of IOL by the same surgeon over a period of one year were analyzed retrospectively. The ethical standards outlined by the Medical Research Council were followed when contacting patients. A well-informed consent was taken from the patient and relative. Eyes with pre-existing retinal pathology had evaluation by a retinal subspecialist before surgery. Postoperative examinations were performed at one day, one week, one month, three months, six months and at one year. Pre-operative and post-operative uncorrected vision, best corrected visual acuity (BCVA) in Snellen visual acuity charts, intraocular pressure (non-contact tonometer), IOL position (ultra sound biomicroscopy and anterior segment optical coherence tomography), anterior chamber reaction (slit lamp microscopy), and retinal evaluation at their last follow-up were analyzed from their concerned case sheets documentation. Subjective changes were analyzed via individual questionnaire. Immediate and late postoperative complications were also evaluated. Surgical modifications and the difference in the operated eyes were analyzed. Only patients with a regular one year follow-up were taken up for the study.

Procedure

Under peribulb anaesthesia, the surgical technique involved conjunctival peritomy and making of two partial scleral thickness limbus based flaps about 2.5 mm × 2.5 mm, at 3 and 9'o clock position (180° opposite to each other) after placing the surgical marker. The flaps were fashioned with the help of crescent blade equidistant from the surgical mark on either side. Infusion was introduced into the eye by a trocar

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Manuscript received: 07.05.12; Revision accepted: 18.11.12

cannula in the infero-nasal or infero-temporal quadrant. Sclerotomy was done with a 22 G needle about 1 mm behind the limbus underneath the flap with the needle directed into the mid-vitreous cavity [Fig. 1]. 0.5 cc of triamcinolone acetonide was injected into the anterior chamber to stain the vitreous for direct visualization. A 25 G vitrectomy cutter was introduced through the sclerotomy wound and thorough vitrectomy was done. A corneal tunnel is fashioned and a three-piece foldable IOL then injected into the eye. For cases needing removal of the previous IOL, a 6.5 mm scleral tunnel at 12'o clock was fashioned. The IOL used was a modified C- Loop with a 5 degree angulation at the optic haptic junction. A glued IOL forcep, which is an end-opening forcep, introduced from the sclerotomy site and the tip of the leading haptic is grasped. When the entire IOL unfolded, the leading haptic was pulled and externalized beneath the flap [Fig. 2]. This then followed by the externalization of the trailing haptic from the other sclerotomy site [Fig. 3]. After both the haptics were externalized, two scleral pockets were created with a 26 G needle in alignment with the sclerotomy wound along the edge of the scleral flap. The tip of 26 G needle was stained with a dye so that the entry point of the scleral pocket got stained and was easy to identify at the end of the surgery when the haptics were to be tucked [Fig. 4]. Vitrectomy is done again at the sclerotomy site to cut down any vitreous strands if present and then the haptics were tucked into the scleral pockets [Fig. 5]. The trocar infusion was removed, air bubble injected, and glue (one drop of fibrinogen preparation followed by a drop of thrombin) was applied under the scleral flap after drying the area [Fig. 6]. The flap was pressed for nearly one minute after placement of the glue, so that it adhered well to the base. The conjunctiva was then sealed with the glue.

In cases of malpositioning of posterior chamber IOL into the anterior chamber (PC IOL in AC) or in cases of AC IOL, the preexisting IOL was explanted through the scleral tunnel and then glued intrascleral fixation of the IOL was done.

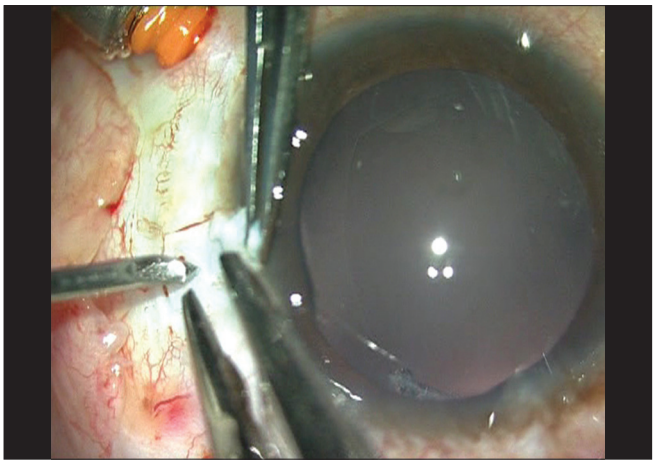

Figure 1: Two partial scleral thickness flaps made 180° apart, trocar infusion introduced followed by sclerotomy. Sclerotomy is done with 22 G needle approximately 1mm behind limbus beneath the scleral flap. The needle is entered into the eye in an obliquely downward direction

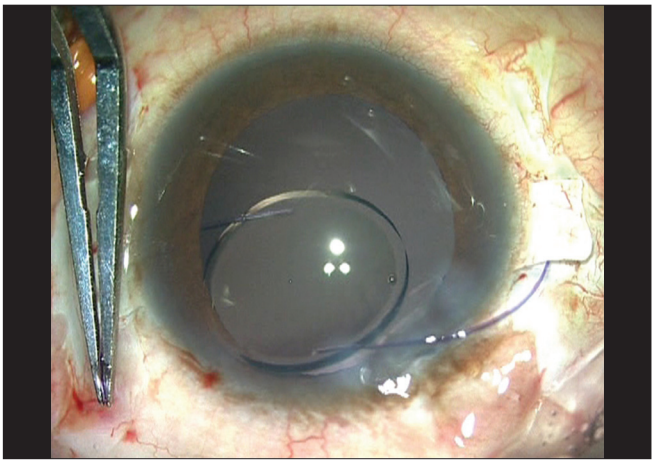

Figure 2: Externalisation of the leading haptic.As the foldable intraocular lens (IOL) unfolds, glued IOL forcep is introduced from left side beneath the scleral flap. The tip of the haptic is caught with the glued IOL forcep; and when the entire IOL unfolds, the haptic is pulled and externalised

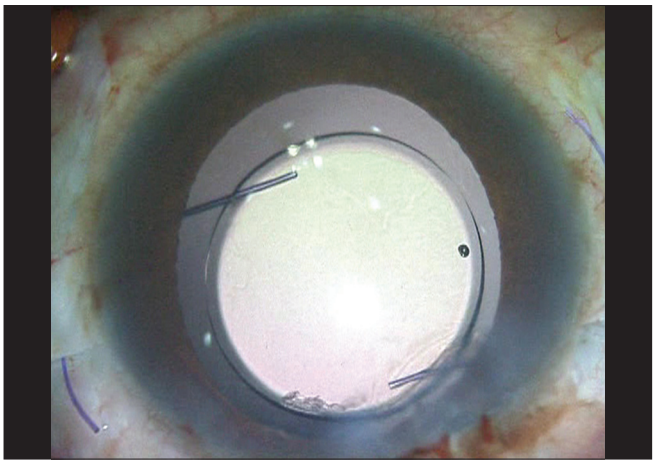

Figure 3: Externalisation of the trailing haptic. Glued IOL forceps is introduced from the right side beneath the sclera flap; the tip of the trailing haptic is caught and then externalised

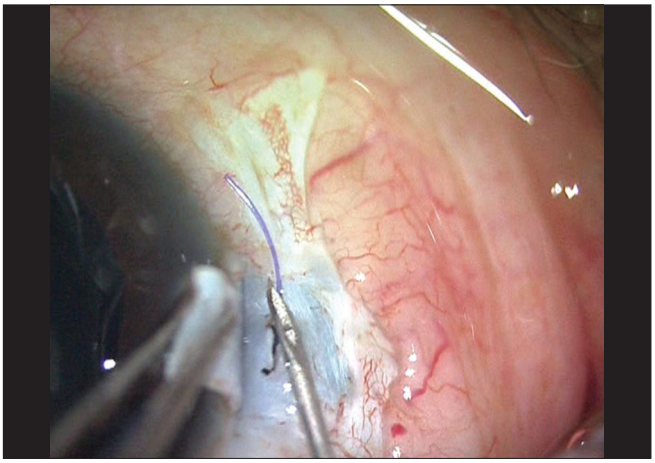

Figure 4: Scleral pockets. Two scleral pockets are made with a bent 26 G needle; one on either side. It is made parallel to the sclerotomy wound at the edge of the flap

Preparation of the glue

The fibrin tissue glue pack is available as freeze-dried three sterile vials containing fibrinogen concentrate (70 mg), thrombin (500 IU) and aprotinin (3000 kiu/ml) each. The vials are placed in a water bath which is preheated to 37 degrees for 2 to 3 minutes. Distilled water (0.5 cc) is then added to thrombin vial, whereas aprotinin is mixed with fibrinogen. Both the components are then filled in separate syringes and a 26 G needle is attached to it.

Results

A total of 28 patient files were identified; however, three patients did not have a one year follow-up and were excluded from the study. The pre-operative and postoperative outcomes of 25 eyes of 22 patients were analyzed with the mean age group of 49.8 years (range from 6-71 years) over a period of one year.

The surgery was done as a primary procedure following a posterior capsular rupture intra-operatively in three (12%) eyes and as a secondary procedure in 22 (88%) eyes. A 3 -piece foldable IOL was implanted in all eyes. The mean pre-op uncorrected visual acuity (UCVA) in decimal equivalent was 0.08 ±0.03 and the mean post-op UCVA was 0.27 ± 0.1 ($P < 0.05$). There was a marked improvement in post-op UCVA except in one case which had CME.

The mean pre-op BCVA in decimal equivalent was 0.25 ± 0.14 and the mean post-op BCVA was 0.57 ± 0.24 ($P < 0.05$).

Fig. 7 shows the gain in lines in BCVA with percentage of cases. 8% cases had a gain in 6 lines, 8% had gain in 5 lines, 20% cases had gain in 4 lines, 8% had gain in 3 lines, 16% had gain in 2 lines, and 24% cases had gain in 1 line of BCVA. 12% of the cases did not gain any line where as 4% cases (1 case) had a fall in BCVA. This fall in BCVA was attributed to CME.

The mean pre-op intraocular pressure (IOP) as measured with non contact tonometry was 17.8 ± 4.43 mm Hg and the mean post-op IOP was 15.7 ± 1.53 mm Hg (paired t test -$P = 0.01$). A marked fall in IOP was seen in 6 cases; out of which 2 cases had an AC IOL, 3 cases were aphakic and 1 case has a PC IOL implanted in the anterior chamber. In only one case, there was marked rise in IOP post-operatively, due to vitritis and CME.

There was no significant intra-operative complication. Postoperative complications included decentration in one case, which was then repositioned by lifting the flap and tucking the haptics. One case had vitritis with chronic macular edema for which topical and peri-ocular steroid injections were given. The mean post-op central foveal thickness as measured with OCT was 193.12 ± 13.07. Fig. 8 shows postoperatively a well-centered IOL on OCT.

Discussion

When the posterior capsule ruptures or there is lack of a zonular support, an IOL can be placed in the anterior chamber between the cornea and iris, as in iris-fixated and closed or open-loop anterior chamber IOL's (AC IOL's),[1] or it can be implanted in the posterior chamber within the ciliary sulcus posterior to the iris, as in sutured iris-fixated and scleral fixated posterior chamber IOL's (PC IOL's).[1-3] Various techniques have been used in the past to implant an IOL in eyes following a posterior capsular rupture; but every technique has its own limitations.

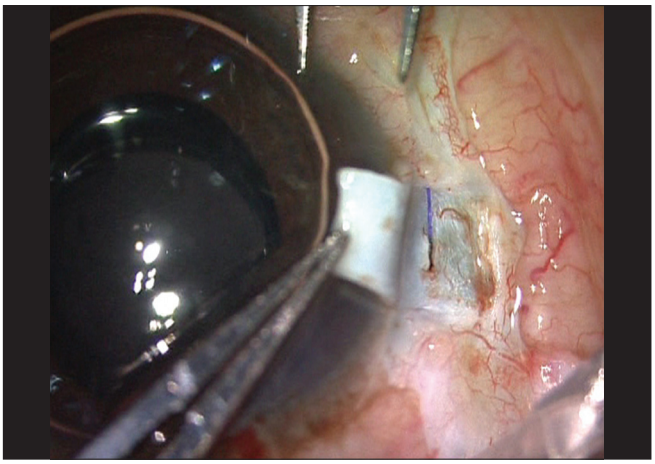

Figure 5: Haptics tucked into the scleral pocket. The haptic is grasped near the tip with the forcep and is then introduced into the scleral pocket on either side. The centration of the IOL can be adjusted by the amount of haptic tucked. After both the haptics are tucked, vitrectomy is done at sclerotomy site to cut any vitreous strand, if present

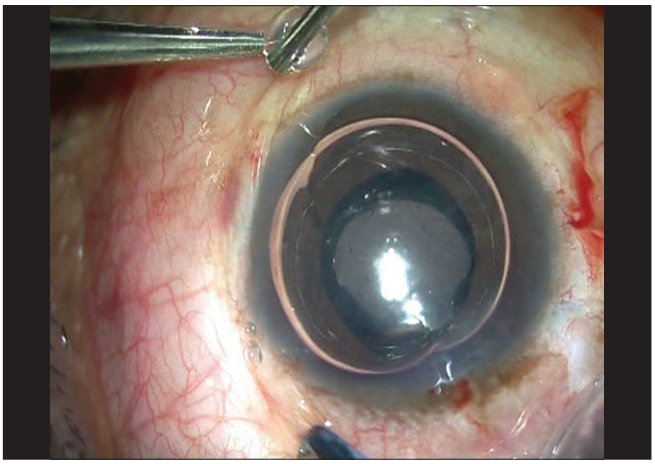

Figure 6: Fibrin glue application. The trocar infusion is removed and the scleral bed is swabbed, so as to be dry. Fibrin glue is then applied beneath the flap (one drop of fibrinogen component followed by a drop of thrombin). The flap is pressed for a minute so that it adheres well to the base. Fibrin glue is also applied beneath the conjunctiva along the peritomy site

Figure 7: Shows the gain in lines in best corrected visual acuity with percentage of cases

Pre-requisites for an AC IOL's implantation are the presence of an anatomically normal anterior chamber and accurate sizing of its horizontal diameter. Inspite of this Apple *et al*.[13] postulated that subclinical uveitis secondary to lens-tissue contact creates inflammatory products that could be directly toxic to the endothelium and angle and could also result in CME.

With iris claw lenses, uveitis–glaucoma–hemorrhage syndrome has been reported and late dislocations may occur. Iris-sutured intraocular lenses can cause cat-like pupil and iris chaffing, with uveitis and/or pigment dispersion and secondary complications such as chronic inflammation and secondary glaucoma. These techniques need sufficient iris stroma for fixation.[14]

Sutured scleral fixated IOL's are associated with visually significant complications due to late subluxation,[15,16] complications related to sutures[17-20] and secondary IOL implantation.[21] In a histologic study,[22] IOL stability was the result of intact scleral sutures and not to fibrous encapsulation or correct placement of the haptic in the ciliary sulcus. As a result,

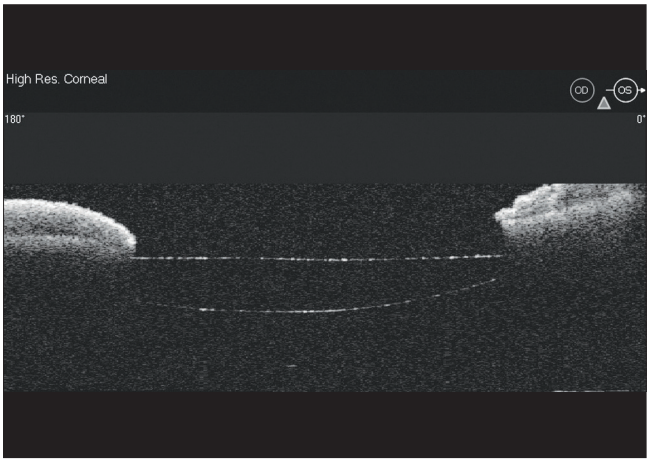

Figure 8: Post-operative optical coherence tomography. It shows a well centered intraocular lens

IOL dislocation is likely to occur if sutures are inadvertently removed or if suture fatigue occurs.[3,23] Two-point suture fixation carries a higher risk of axial IOL tilt, and 3 or 4 point fixation heightens the risk for complications resulting from increased intraocular manipulations.

Glue assisted intrascleral fixation differs from other sutureless techniques[24-26] in a way that two partial scleral thickness flaps are made 180 degrees apart and the scleral pockets are made at the edge of the flap base, parallel to the sclerotomy wound. The haptics are tucked in the scleral pockets and the flaps are then adhered to the base with the help of tissue fibrin glue. The glue also helps in sealing the sclerotomy site which would otherwise act as a filtration site and cause hypotony.

This technique has an advantage in that it can be performed in the presence of significant structural abnormalities of the anterior chamber and that it mitigates many of the adverse outcomes associated with AC IOL's, iris fixated IOL's and sutured scleral fixated IOL's.

The Table 1 below helps compare the three techniques, which can be implemented for the IOL fixation in the posterior chamber following a posterior capsular rupture.

In this technique, a standard three-piece intraocular lens with a haptic design fitting to the diameter of ciliary sulcus is implanted. The haptic is placed in its normal curved configuration without traction, there is no distortion or change in the shape of the IOLoptic.[10] Externalization of the greater part of the haptic along its curvature stabilizes the axial positioning of the IOL and thereby prevents IOL tilt.[10,27-29] The use of scleral tunnel fixation of the haptic is less technically demanding because it stabilizes the intraocular lens in the posterior chamber without difficult suturing procedures.[14] Placing the IOL haptic beneath the flap prevents further movement of the haptic, reducing the pseudophacodonesis[10,30] that leads to constant motion in the vitreous and, ultimately, to retinal damage. The ends of the haptic are left in the tunnel to prevent foreign body sensation and erosion of the conjunctiva and to reduce the risk of inflammation.[14]

Table 1: Comparison of varied techniques of IOL fixation in Posterior Chamber after PC rupture

	Retro Iris fixation	Sutured Scleral fixation	Glue assisted intrascleral fixation
Pros	• Fast procedure • Can be done under Topical anesthesia	• Long term studies available	• No pseudophacodonesis • No late decentration seen • No specially designed IOL needed • Fast procedure • Has all the advantagesof a small incision surgery
Cons	• Pseudophacodonesis • Iritis and Inflammation • Needs specially designed IOL • Dependent on pupil shape and size • Cannot be done in iris defects and malformations	• IOL tilt and decentration • Suture erosion and exposure • Pseudophacodonesis • Vitritis • CME and RD reported • Vitreous hemorrhage • Technically demanding • Needs specially designed IOL • Time consuming	• Needs an end opening Glued IOL forceps • Learning curve • Requires fibrin tissue glue

Post-operatively, one case had a decentered IOL on the first post operative day. The scleral flap was lifted and the haptic was tucked again in the scleral pocket followed by application of the glue. The IOL was well centered the next day as confirmed by OCT. Vitritis and cystoid macular edema was present in one case for which peri-ocular and topical steroids were given. This patient had a fall in three lines of BCVA even after one year of follow up. No other major complication like retinal detachment, vitreous hemmorhage, endophthalmitis, or hyphema was noted.

The limitation of this study is its single-center and retrospective nature, only one year of follow-up, small heterogeneous subgroups of patients and preoperative pathology. Long-term studies are needed to prove the efficacy of this technique.

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Cite this article as: Narang P, Narang S. Glue-assisted intrascleral fixation of posterior chamber intraocular lens. Indian J Ophthalmol 2013;61:163-7.

Source of Support: Nil. **Conflict of Interest:** None declared.